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EXAMINER

YEVSIKOV, VICTOR V

ART UNIT PAPER NUMBER

2891

DATE MAILED: 11/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/808,793

Applicant(s)

HILL ET AL.

Examiner

Victor V. Yevsikov

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>3/24/4</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2 and 7-9 rejected under 35 U.S.C. 102(a) as being anticipated by Chao et al. (US 2005/0098821 A1).

With respect to claims 1 Chao teaches a method for lithography patterning of the thin film stacks, comprising:

forming a thin film stack on a substrate, wherein the thin film stack includes at least a polysilicon layer 106, 113 and an oxide layer 104, 111;

forming a hard mask layer 114, 115 comprised an anti-reflective coating (ARC) layer (§ 0026) on the thin film stack;

patterning the ARC layer (figs. 6,7);

etching the hard mask layer using the patterned ARC layer as a mask (fig. 6);

and

etching the thin film stack using the hard mask layer as a mask (figs. 9, 10).

With respect to claims 5, 6, 8 and 9 Chao teaches a method wherein

the hard mask layer comprises a material that has high selectivity to both polysilicon and oxide etches chemistries.

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the hard mask layer comprises amorphous carbon.

ARC layer is removed during the etching of the thin film stack.

removing the hard mask material from the thin film stack.

With respect to claims 10 Chao teaches a method for lithography patterning of the thin film stacks, comprising:

forming a thin film stack on a substrate, wherein the thin film stack includes at least a polysilicon layer 106, 113 and an oxide layer 104, 111;

forming a hard mask layer 114, 115 comprised an anti-reflective coating (ARC) layer (§ 0026) on the thin film stack;

patterning the ARC layer (figs. 6,7);

etching the hard mask layer using the patterned ARC layer as a mask (fig. 6);

and

etching the flash memory gate stack using the hard mask layer as a mask (figs. 9, 10).

With respect to claims 5, 6, 8 and 9 Chao teaches a method wherein

the hard mask layer comprises a material that has high selectivity to both polysilicon and oxide etches chemistries (§0026);

the hard mask layer comprises amorphous carbon (§0026);

ARC layer is removed during the etching of the thin film stack (fig.10).

removing the hard mask material from the thin film stack.

With respect to claims 10 Chao teaches a method for lithography patterning of the thin film stacks, comprising:

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forming a thin film stack on a substrate, wherein the thin film stack includes at least a polysilicon layer 106, 113 and an oxide layer 104, 111;

forming a hard mask layer 114, 115 comprised an anti-reflective coating (ARC) layer (§ 0026) on the thin film stack;

patterning the ARC layer (figs. 6,7);

etching the hard mask layer using the patterned ARC layer as a mask (fig. 6);
and

etching the flash memory gate stack using the hard mask layer as a mask (figs. 9, 10).

With respect to claims 13, 15, 16, 18 and 19 Chao teaches a method wherein:

the flash memory gate stack is comprised of a gate dielectric layer 104, a floating gate layer 111, an inter-electrode dielectric layer 112, and a control gate electrode layer 113;

the hard mask layer comprises a material that has high selectivity to both polysilicon and oxide etches chemistries (§0026);

the hard mask layer comprises amorphous carbon (§0026);

the ARC layer is removed during the etching of the flash memory gate stack and removing the hard mask material from the flash memory gate stack (fig.10).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2 —4, 11, 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chao in view of Mahorowala et al. (US 6,869,899 B2).

Chao discloses the features out lined above, but does not show exactly a method wherein the ARC layer is patterned with resist using 193 nm or less lithography; the thickness of the resist is less than 5000 Å; and the hard mask layer has a thickness of between 1000 and 3000 Å and the ARC layer has a thickness of between 100 and 500 Å.

However, Mahorowala teach the method wherein the ARC layer is patterned with resist using 193 nm or less lithography; the thickness of the resist is less than 5000 Å; and the hard mask layer has a thickness of between 1000 and 3000 Å and the ARC layer has a thickness of between 100 and 500 Å (reference: figs. 1B, 2A with corresponding text; col. 1, lines 16-39; col. 2, lines 40-49; cl. 18).

It would have been obvious to those skilled in the art using 193 nm lithography and resist, hard mask and ARC layers as taught by Chao / Mahorowala for provides method for producing a lithographically printed image having a reduced critical dimension.

Claims 7 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chao in view of Kumar et al. (US 2005/0079706 A1).

Chao discloses the features out lined above, but does not show exactly a method wherein the hard mask layer comprises Applied Materials film.

However, Kumar teach the method wherein the hard mask layer comprises Applied Materials film (§0041).

It would have been obvious to those skilled in the art using Applied Materials film as taught by Chao / Kumar for provides method for reduced critical dimension.

Remarks

Response to Arguments

Applicant's arguments with respect to claims 1-19 have been considered but they are not persuasive. The combinations detail each and every element of applicant's claims or further show the invention of applicant's is an obvious development from the prior art and using anti-reflective coating.

Chao ('821) teach (§ 0026) "The ARC hard mask layer serves to eliminate undesirable optical effects from subsequent lithography operations. Ideally, the hard mask will comprise a material that can be selectively etched with respect to the gate stack layers. The ARC hard mask layer may be comprised of an oxide/oxynitride film stack (which is the ARC at present claims). In other embodiments, the ARC hard mask layer may be comprised of nitride or carbon (which is material for the hard mask layer at present claims).. In the specification applicant teach "The ARC layer may be comprised of silicon dioxide, silicon oxynitride or a composite thereof".

So, according the applicant, ARC and hard mask may be comprised same materials, as reference.

Also, hard mask layer, according the Chao, serves to eliminate undesirable optical effects from subsequent lithography operations. In this case hard mask layer should be cover another layers for protection.

Conclusion

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Notice of Finality

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1. 136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1. 136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

V. Yevsikov

Victor Yevsikov
Examiner
Art Unit 2891

November 9, 2005


B. WILLIAM BAUMEISTER
SUPERVISORY PATENT EXAMINER